DIRECT TESTIMONY AND EXHIBITS OF

BRANDON S. BICKLEY

ON BEHALF OF

THE SOUTH CAROLINA OFFICE OF REGULATORY STAFF

DOCKET NO. 2021-3-E

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS AND OCCUPATION.

A. My name is Brandon S. Bickley. My business address is 1401 Main Street, Suite 900, Columbia, South Carolina 29201. I am employed by the State of South Carolina as a Senior Regulatory Analyst for the Office of Regulatory Staff ("ORS").

Q. PLEASE STATE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I received my Bachelor of Science Degree with a major in Mechanical Engineering from the University of South Carolina in 2010. From 2010 to 2013, I was employed as a Nuclear Engineer, Reactor Fuel Safety Officer, and Shift Refueling Engineer at Norfolk Naval Shipyard. In that capacity, I performed engineering and operational duties in support of the United States Navy related to reactor servicing, reactor fuel, special nuclear material, special nuclear projects, security, and safety. From 2013 to 2017, I was employed as an Inspections, Tests, Analyses, and Acceptance Criteria ("ITAAC") Engineer with South Carolina Electric & Gas Company ("SCE&G"). In that capacity, I obtained the level of a Senior Engineer and performed ITAAC reviews and construction oversight for SCE&G. From 2017 to 2019, I was employed by Savannah River Remediation as a Senior Engineer. In that capacity, I performed systems engineering duties in support of the Defense Waste Processing Facility for Savannah River Remediation. I began my employment with ORS

as a Regulatory Analyst in July of 2019. In August of 2021 I was promoted to my current position in the Energy Operations Division as a Senior Regulatory Analyst.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA ("COMMISSION")?

A. Yes. I have previously testified before the Commission on several occasions including annual fuel proceedings, general rate cases, and a proceeding related to the Utility Facility Siting and Environmental Protection Act.

Q. WHAT IS THE MISSION OF ORS?

A. ORS represents the public interest as defined by the South Carolina General Assembly in S.C. Code Ann. § 58-4-10 as:

> [T]he concerns of the using and consuming public with respect to public utility services, regardless of the class of customer, and preservation of continued investment in and maintenance of utility facilities so as to provide reliable and high-quality utility services.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING AND HOW DOES YOUR DIRECT TESTIMONY REPRESENT THE PUBLIC INTEREST?

A. The purpose of my direct testimony is to set forth ORS's recommendations resulting from ORS's examination and review of Duke Energy Carolinas, LLC's ("DEC" or the "Company") power plant operations used in the generation of electricity to meet the Company's South Carolina retail customer requirements during the review period. The review period includes the actual data for June 2020 through May 2021 ("Actual Period"), estimated data for June 2021 through September 2021 ("Estimated Period"), and forecasted data for October 2021 through September 2022 ("Forecasted Period"). My review focused

on ensuring the Company efficiently operated its plants and made every reasonable effort to minimize fuel costs so as to provide reliable and high-quality service to its customers.

Q. WAS THE REVIEW TO WHICH YOU TESTIFY PERFORMED BY YOU OR UNDER YOUR SUPERVISION?

A. Yes, the review to which I testify was performed by me or under my supervision.

Q. PLEASE DESCRIBE YOUR REVIEW OF THE COMPANY'S PLANT OPERATIONS.

A. In preparation for this proceeding, ORS examined various fuel and performance documents related to the Company's electric generation and power plant outage and maintenance activities. ORS analyzed DEC's monthly fuel reports including power plant performance data, unit outages, heat rate data, and generation statistics. ORS also monitored electric generation statistics through industry and governmental publications.

ORS attended, via virtual participation, the April 1, 2021 Nuclear Regulatory Commission's ("NRC") 2020 Annual Assessment meeting for the Catawba, McGuire, and Oconee Nuclear Stations. Additionally, ORS met, via virtual participation, with Company personnel from various departments to discuss and review the Company's electric generation, power plant outages, and maintenance activities.

Q. DID ORS EXAMINE THE COMPANY'S PLANT OPERATIONS FOR THE ACTUAL PERIOD?

A. Yes. ORS reviewed the performance of DEC's generation units to determine if the Company made reasonable efforts to maximize unit availability and every reasonable effort to minimize fuel costs. ORS also reviewed the operating statistics of the Company's power plants by unit. Exhibit BSB-1 shows, in percentages, the average availability, average net

capacity, and average forced outage factors of the Company's major generation units during the Actual Period. Exhibit BSB-1 also includes the North American Electric Reliability Corporation ("NERC") national five-year (2015-2019) averages for availability, capacity, and forced outage factors for each type of generation plant.

Q. PLEASE EXPLAIN HOW OUTAGES ARE REPRESENTED ON EXHIBITS BSB-2 THROUGH BSB-4.

A. Exhibits BSB-2 and BSB-3 summarize outages lasting seven (7) or more days for major coal and natural gas units, respectively, during the Actual Period. While not all plant outages are included in these exhibits, all outages were reviewed. ORS reviewed the outages, including information and data provided by the Company in testimony and discovery, and discussed the outages with DEC management. ORS found the outages that were reviewed to be reasonable based on ORS's review of the outage data from the Actual Period, forecasted outage data from Docket No. 2020-3-E, historical outage data from previous annual fuel proceedings, and industry experience. Plant outages that are not complete at the end of the Actual Period and plant outages where final reports are not available will be reviewed by ORS for reasonableness of the outages in the review period during which the outage is completed or when the reports become available. For this review period, Marshall Unit 3's Planned Outage starting on February 26, 2021 was not completed until after May of 2021. Therefore, ORS will review this outage during the next fuel proceeding.

Exhibit BSB-4 shows the duration, type, and cause of each outage for the nuclear units during the Actual Period. There were seven (7) separate outages involving DEC's nuclear units, including three (3) scheduled refueling outages and four (4) forced outages.

ORS reviewed the outages, including information and data provided by the Company in testimony and discovery as well as associated NRC documents, and discussed the outages with DEC management. ORS found the outages that were reviewed to be reasonable based on ORS's review of the outage data from the Actual Period, forecasted outage data from Docket No. 2020-3-E, historical outage data from previous annual fuel proceedings, and industry experience.

Q. WHAT WERE THE RESULTS OF ORS'S ANALYSIS OF THE COMPANY'S POWER PLANT OPERATIONS FOR THE ACTUAL PERIOD?

A. Based on ORS's review of the Company's operation of its generation facilities during the Actual Period, ORS determined that the Company made reasonable efforts to maximize unit availability and every reasonable effort to minimize fuel costs.

Q. DID ORS REVIEW THE COMPANY'S GENERATION MIX DURING THE ACTUAL PERIOD?

A. Yes. Exhibit BSB-5 shows the generation mix for the Actual Period by percentage and generation type. As shown in this exhibit, the nuclear, coal, and natural gas plants contributed an average of approximately 56.75%, 16.33%, and 16.07%, respectively, of the Company's generation throughout the Actual Period. This equates to approximately 89.15% of the Company's generation for the Actual Period. The remainder of the generation was met through a mix of renewables (hydroelectric, solar, and biogas), purchased power, and Joint Dispatch Agreement ("JDA") purchases.

Q. DID ORS REVIEW THE COMPANY'S FUEL COSTS ON A PLANT-BY-PLANT BASIS FOR THE ACTUAL PERIOD?

A. Yes. Exhibit BSB-6 shows the average fuel costs for the major generation plants on the Company's system for the Actual Period and the megawatt-hours ("MWh") produced by those plants. The exhibit shows the lowest average fuel cost of 0.561 cents/kilowatt-hour ("kWh") at the McGuire Nuclear Station and the highest average fuel cost of 3.552 cents/kWh at the Marshall Steam Station. The Company utilizes economic dispatch which generally requires the lower cost units to be dispatched first.

Q. DID ORS REVIEW THE COMPANY'S FORECASTED POWER PLANT OPERATIONS FOR THE ESTIMATED AND FORECASTED PERIODS?

A. Yes. ORS reviewed DEC's maintenance schedules and projected performance data for its power plants for the Estimated and Forecasted Periods including the updated data and information provided in the Company's Supplemental Direct Testimony. ORS compared the maintenance schedules and performance data to previous data and information from Docket No. 2020-3-E, maintenance schedules and performance data from the Actual Period, and historical projections from previous annual fuel proceedings. Based on its review, ORS found the Company's maintenance schedules and projected data for its power plants for the Estimated and Forecasted Periods to be reasonable.

Q. DOES ORS RECOMMEND ANY ADJUSTMENTS TO THE FUEL FACTORS PROPOSED BY DEC BASED ON DEC'S POWER PLANT OPERATIONS?

A. No. ORS does not recommend any adjustments to the Fuel Factors based on the Company's power plant operations.

Q. WILL YOU UPDATE YOUR DIRECT TESTIMONY BASED ON INFORMATION THAT BECOMES AVAILABLE?

A. Yes. ORS fully reserves the right to revise its recommendations via supplemental testimony should new information not previously provided by the Company, or other sources, becomes available.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

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EXHIBIT BSB-1

Power Plant Performance Data

Duke Energy Carolinas, LLC

Docket No. 2021-3-E

Coal/Dual Fuel Plants	Unit	MW Rating	*Actual Period Data* Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Belews Creek[2]	1	1,110	77.43	48.44	4.50
Belews Creek[2]	2	1,110	56.47	33.76	1.71
Cliffside[2]	5	544	67.53	22.28	7.82
Cliffside[2]	6	844	72.56	53.06	2.22
Marshall[3]	1	370	79.98	32.01	8.78
Marshall[3]	2	370	75.44	36.89	15.70
Marshall[2]	3	658	56.08	40.87	1.72
Marshall[2]	4	660	59.77	38.65	19.73
Coal Totals		**5,666**	70.08	34.37	5.69
NERC 5-year average (All Coal Plants)			***82.44***	***51.99***	***5.11***

CC Plants[1]	Unit	MW Rating	Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Buck	10	668	80.35	61.86	0.00
Dan River	7	662	86.82	64.11	0.37
WS Lee	10	786	87.85	80.18	0.13
CC Totals		**2,116**	85.11	69.12	0.17
NERC 5-year average (CC Plants)			***88.05***	***54.76***	***2.24***

Nuclear Plants	Unit	MW Rating	Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Catawba	1	1,160	99.67	100.65	0.24
Catawba	2	1,150	89.77	89.00	1.46
McGuire	1	1,158	91.21	92.70	1.12
McGuire	2	1,158	99.19	100.69	0.81
Oconee	1	847	91.17	92.55	0.00
Oconee	2	848	100.00	102.92	0.00
Oconee	3	859	100.00	101.78	0.00
Nuclear Totals		**7,180**	95.86	96.96	0.52
NERC 5-year average (All Nuclear Plants)			***92.65***	***91.73***	***1.54***

[1] *CC designates Combined-Cycle units*

[2] *Belews Creek U1 and U2, Cliffside U5 and U6, and Marshall U3 and U4: dual fuel (co-fire coal or natural gas)*

[3] *Marshall U1 and U2: coal-fired (dual fuel operation projects are currently underway)*

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Coal/Dual Fuel Unit Outages - 7 Days or Greater Duration

Duke Energy Carolinas, LLC

Docket No. 2021-3-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Belews Creek 1	10/17/20	11/17/20	745.17	Planned	Unit taken offline for a planned Fall outage.
Belews Creek 1	11/17/20	12/18/20	759.52	Extension	Unit taken offline for planned outage extension.
Belews Creek 2	9/12/20	12/10/20	2,142.98	Planned	Unit taken offline for a planned Fall outage.
Belews Creek 2	12/10/20	1/17/21	916.40	Extension	Unit taken offline for a planned outage extension.
Belews Creek 2	5/5/21	5/15/21	217.00	Planned	Unit taken offline for planned Spring outage.
Cliffside 5	6/20/20	7/10/20	493.00	Planned	Unit taken offline for planned Summer outage.
Cliffside 5	7/24/20	8/6/20	310.63	Forced	Unit forced offline due to a water wall tube leak.
Cliffside 5	9/21/20	10/3/20	282.00	Maintenance	Maintenance outage due to pre-heater wash and basket replacement work.
Cliffside 5	10/3/20	10/17/20	344.00	Planned	Unit taken offline for planned Fall outage.
Cliffside 5	11/14/20	11/26/20	299.52	Maintenance	Maintenance outage to replace boiler circulating pump and inspections.
Cliffside 5	1/1/21	1/8/21	185.50	Maintenance	Maintenance outage due to seal oil system inspection and repair.
Cliffside 5	3/29/21	4/10/21	288.00	Maintenance	Maintenance outage due to boiler inspection and installation of booster fan motor.
Cliffside 6[1]	5/30/20	7/10/20	990.00	Planned	Unit taken offline for planned Spring outage.
Cliffside 6	7/11/20	7/19/20	188.20	Startup Failure	Startup failure due to an air heater gearbox failure.

[1] Outage started before the Actual Period (June 2020 through May 2021)

Office of Regulatory Staff
Coal/Dual Fuel Unit Outages - 7 Days or Greater Duration
Duke Energy Carolinas, LLC
Docket No. 2021-3-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Cliffside 6	4/17/21	5/29/21	1,020.50	Planned	Unit taken offline for planned Spring outage.
Marshall 1	4/13/21	5/6/21	542.25	Maintenance	Maintenance outage for repairs due to coal burner fire.
Marshall 2	10/10/20	10/23/20	328.00	Planned	Unit taken offline for planned Fall outage.
Marshall 2	1/29/21	2/10/21	282.50	Maintenance	Maintenance outage for BFPT Control Valve Repairs.
Marshall 2	2/18/21	4/7/21	1,143.50	Startup Failure	Startup failure due to Boiler Recirculation Pump motor failure.
Marshall 3	9/12/20	10/29/20	1,138.45	Planned	Unit taken offline for planned Fall outage.
Marshall 3[1]	2/26/21	6/1/21	2,257.00	Planned	Unit taken offline for planned Spring outage.
Marshall 4	7/5/20	8/15/20	965.68	Planned	Unit taken offline for planned Summer outage.
Marshall 4	10/10/20	12/18/20	1,644.47	Forced	Unit forced offline due to Generator Stator ground indication.
Marshall 4	3/11/21	4/10/21	718.25	Planned	Unit taken offline for planned Spring outage.

[1] Outage was completed after the Actual Period (June 2020 through May 2021)

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EXHIBIT BSB-3

Combined Cycle Unit Outages - 7 Days or Greater Duration

Duke Energy Carolinas, LLC

Docket No. 2021-3-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Buck	9/5/20	11/3/20	1,426.02	Planned	Unit taken offline for a planned Fall outage.
Buck	4/3/21	4/13/21	261.10	Planned	Unit taken offline for planned Spring outage.
Dan River	11/30/20	12/19/20	455.58	Planned	Unit taken offline for planned Fall outage.
Dan River	4/2/21	4/30/21	676.90	Planned	Unit taken offline for planned Spring outage.
WS Lee	6/5/20	6/21/20	380.67	Planned	Unit taken offline for a planned Spring outage.
WS Lee	12/1/20	12/18/20	408.18	Planned	Unit taken offline for planned turbine repair.
WS Lee	3/5/21	3/25/21	486.47	Planned	Unit taken offline for a planned Spring outage.

Office of Regulatory Staff
Nuclear Unit Outages
Duke Energy Carolinas, LLC
Docket No. 2021-3-E

EXHIBIT BSB-4

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Catawba 1	9/8/20	9/9/20	20.62	Forced	Unit forced offline due to automatic reactor trip initiated by human performance error during power range NIS cross calibrations.
McGuire 1	9/19/20	10/17/20	672.00	Planned	Unit taken offline for a scheduled refueling outage.
McGuire 1	10/17/20	10/21/20	98.23	Forced	Unit forced offline due to repair of valve 1NI-60.
Oconee 1	10/16/20	11/18/20	773.50	Planned	Unit taken offline for a scheduled refueling outage.
McGuire 2	2/21/21	2/24/21	70.70	Forced	Unit forced offline due to concerns with water content in the secondary side oil systems.
Catawba 2	3/27/21	4/28/21	768.00	Planned	Unit taken offline for a scheduled refueling outage.
Catawba 2	4/28/21	5/3/21	127.87	Forced	Unit forced offline due to required repairs on one of the reactor head penetration nozzles.

EXHIBIT BSB-5

Office of Regulatory Staff
Generation Mix (Percentages)
Duke Energy Carolinas, LLC
Docket No. 2021-3-E

	2020							2021					
	June	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Average**
Nuclear	57.26	50.94	51.38	56.98	57.08	60.21	57.26	55.89	54.28	62.68	58.52	61.55	**56.75**
Coal	19.38	20.95	24.14	14.36	9.93	12.39	14.34	13.61	19.12	12.79	17.12	14.63	**16.33**
Natural Gas[1]	13.67	17.06	16.28	16.90	17.79	16.67	13.57	19.86	16.12	15.16	13.86	15.54	**16.07**
Hydroelectric	1.64	0.58	1.53	2.40	3.03	3.54	2.13	1.79	2.02	3.13	3.07	1.19	**2.10**
Solar	0.17	0.16	0.13	0.15	0.16	0.12	0.11	0.18	0.20	0.30	0.38	0.27	**0.19**
Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Purchased Power	3.53	3.60	3.48	3.33	4.07	4.03	4.88	2.98	3.08	3.51	3.41	3.76	**3.63**
JDA Purchases	4.34	6.70	3.04	5.88	7.95	3.04	7.72	5.69	5.19	2.43	3.65	3.08	**4.92**

Numbers may not equal 100% due to rounding

[1] ***Includes Combined Cycle, Combustion Turbine, Steam, and Biogas***

Office of Regulatory Staff
Generation Statistics for Major Plants
Duke Energy Carolinas, LLC
Docket No. 2021-3-E

EXHIBIT BSB-6

Plant	Fuel Type	Average Fuel Cost (¢/kWh)[1]	Generation (MWh)
McGuire	Nuclear	0.561	19,616,898
Oconee	Nuclear	0.578	22,171,512
Catawba	Nuclear	0.578	19,193,688
WS Lee CC	Natural Gas	2.232	5,616,222
Buck CC	Natural Gas	2.256	3,910,114
Dan River CC	Natural Gas	2.264	4,036,725
Cliffside[2]	Coal/Natural Gas	3.222	5,011,326
Belews Creek[2]	Coal/Natural Gas	3.545	7,992,548
Marshall[2, 3]	Coal/Natural Gas	3.552	6,883,629

[1] ***Includes Base Fuel and Environmental Costs***

[2] ***Belews Creek U1 and U2, Cliffside U5 and U6, and Marshall U3 and U4: dual fuel***

[3] ***Marshall U1 and U2: coal-fired***